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For: INTERNAL JIGGING  
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### **Internal Jigging**

#### **Related Application**

This application is a continuation of International Application No. PCT/AU02/00322, filed March 20, 2002, which was published under PCT Article 21(2) in English and is incorporated  
5 herein by reference. International Application No. PCT/AU02/00322 claims priority from Australian Patent Application No. PR 3851, filed March 20, 2001, which is also incorporated herein by reference.

#### **Technical Field**

This invention relates to jigs and jigging devices. In particular this invention relates to  
10 jigging devices which may be regarded as internal and permanent compared to known jigging arrangements.

The invention also relates to a novel method of jigging.

#### **Background Art**

Jigs and jigging devices are generally well known and widely used in manufacture.  
15 Typically, a jig will have various reference surfaces and/or points to permit accurate alignment of parts or tools. It is common to jig parts during many manufacturing processes, so that the parts are held in correct juxtaposition during such processes as punching, riveting, welding, gluing or curing. Jigs are regarded as an essential part of the manufacturing process and represent a significant part of the cost of manufacture as well as demanding logistical  
20 consideration during production.

Most jiggling processes are carried out using jigs which are external to the object being formed. Such prior art jiggling processes often require clamps, temporary braces or profiles of the final form of the object.

- Some of the problems presented by prior art jiggling can be described, by way of example, in connection with the manufacture of steel-framed vehicles. In the manufacture of such vehicles, in this example the frame is tubular and panels for the vehicle are glued to the frame. During the adhesion process, it is necessary to adjust one panel relative to another and to hold the panels in the correct position while the adhesive cures. In the past, this has been achieved by the use of external clamps, etc. There are drawbacks with the use of clamps, however. For example, clamps must be carefully removed and returned to the panel assembly station, complicating production line issues. Often, damage is caused to the panels due to the pressure required to hold the parts together. Clamps do not contribute to the final assembly strength. In addition, their presence precludes painting and access to other production line issues, such as cabling.
- In many instances, it is not possible to progress the vehicle along an assembly line until the adhesive has cured. This results in inefficiency in the manufacturing process, with a costly time delay and/or the need for multiple adhesive stations.

### **Disclosure of the Invention**

- It is an aim of the present invention to provide a jiggling device and a method of jiggling which, at least in some embodiments, can allow parts to be positioned using internal, not external, means. It is a further aim of this invention, in some embodiments, to enable automated and programmed tolerance control during the pre-assembly process. It is a further

aim to provide jigging which need not be removed, so that assembly line procedures can continue uninterrupted.

Accordingly, this invention provides a jigging device for maintaining a first element in spatial relationship to a second element, the device including a first fastening means for connection

5 to the first element and a second fastening means for connection to the second element, at least one of the first and second fastening means including adjustment means for adjusting the spatial relationship between the first and second elements, characterized in that the first fastening means has a portion adapted for receipt in a portion of the second fastening means, the device also including locking means adapted to assume a position in which the first  
10 fastening means is locked to the second fastening means, the locking means in the locked position being located within the portion of the first fastening means received within the portion of the second fastening means and adapted to press the received portion of the first fastening means outwardly against the receiving portion of the second fastening means.

The invention also includes a jigging method for maintaining a first element in spatial

15 relationship to a second element, the method including the steps of:

(1) connecting a first fastening means to the first element;

(2) connecting a second fastening means to the second element;

(3) adjusting the spatial relationship of the first element to the second element via adjustment means; and

20 (4) inserting a portion of the first fastening means in a portion of the second fastening means; and

(5) causing a locking means to move to a position within the first fastening means where the locking means presses outwardly against the portion of the first fastening means inserted in the second fastening means, thus locking the first fastening means to the second fastening means.

- 5     Preferably, step (5) is followed by step (6) in which the first element is connected to the second element via adhesion, welding or a similar manufacturing process.

It is to be understood that in the jiggling method of the invention, the steps can be carried out in an order different from that set out above. By way of example, step (2) can be carried out after step (3).

- 10    The first element and the second element can be chosen from a wide variety of options. By way of example, in the manufacture of framed vehicles, the first element may be part of a tubular frame for the vehicle, while the second element may be a panel. Using the jiggling device or method of the invention, the panel may be adjusted in any desired spatial relationship to the frame. For example, the panel may be adjusted to be closer to or further  
15    away from the frame. The panel may be adjusted so as to be closer to or further away from an adjacent panel.

- The first and second fastening means and the adjustment means may similarly be chosen from a wide variety of options, as can the locking means. While it is to be understood that the first and second fastening means, the adjustment means and/or the locking means may be  
20    manipulated manually or presented in a relatively unsophisticated form, it is preferred that the locking means, at least, can be activated, to be locked or unlocked, remotely. In this regard, the contents of international patent application No. PCT/AU99/00185 are imported herein by

reference. This specification discloses various forms of locking means and remote activation for such locking means and adjustment means.

It is an option with the jiggling device and method of the invention that the adjustment means may be associated more with one fastening means than the other. It is a further option that a  
5 first adjustment means is associated with the first fastening means and a second adjustment means is associated with the second fastening means, enhancing the ways in which the spatial relationship can be changed.

Using the jiggling device and method of the invention, it is possible to adjust one element such as a panel in an exact spatial relationship with a second element such as a steel frame,  
10 release the first element from the second element and relocate the same panel or a substitute panel (if the first panel is damaged) in the exactly required location on the frame. Further, it is possible, after the respective elements have been located in the correct position, to remove one of the elements, apply adhesive and replace that element, once again in the exact required location. In this embodiment, the jiggling device of the invention will hold the first element in  
15 the correct location with respect to the second element while the adhesive cures.

The fastening means may be connected to the element in any desired way, including by using adhesive, by using a collar into which the fastening means can be fitted, by using double-sided tape (of suitable peel strength), by otherwise attaching the first fastening means to the element, or by moulding or forming the fastening means in or on the element.

20 The adjustment means may provide adjustment in any desired manner. By way of example, the adjustment means may have a series of serrations or a screw thread, in each case adapted

to be received in a complementary shape. By way of further example, the adjustment means may have first and second parts, one being able to slide into the other to permit adjustment.

While the jiggling device of the invention can incorporate locking means working along the same principle as the fastening and release systems of international patent application No.

- 5 PCT/AU99/00185, it is a further option that the jiggling device of the invention may be "intelligent" -namely, the jiggling device may possess means which enables automated adjustment of the first element relative to the second element. By way of example, the intelligent means may be capable of sensing an undesirable gap between adjacent panels and of automatically activating the adjustment means to close the gap so that it falls within a
- 10 preset tolerance. In this way, panels, etc, can become self-adjusting.

- It is also to be understood that the jiggling device and method of the invention can be used in different ways. The jiggling device can be used to temporarily fasten one element to another, while enabling the accurate positioning of the elements. Once the correct position of the elements has been achieved, one element can be locked to the other by use of the jiggling
- 15 device of the invention. Optionally, the jiggling device can permit disassembly of the elements while potentially maintaining the correct setting. On this basis, when the elements are assembled again, they immediately are located in the correct, predetermined, relative position.

### **Brief Description of the Drawings**

- 20 The invention will now be described in relation to certain non-limiting embodiments illustrated in the attached drawings, in which:

Figures 1 to 3 illustrate, in cross-sectional view, a first embodiment of the jiggging device and method of the invention;

Figures 4 to 9 illustrate in more detail and in magnified view some of the parts of the embodiment shown in Figures 1 to 3;

- 5    Figures 10 to 13 illustrate in cross-sectional view a second embodiment of the jiggging device and method of the invention;

Figure 14 is a magnified view of the second embodiment;

Figures 15 and 16 show the second embodiment in longitudinal cross-sectional view;

Figure 17 is a top view of the second embodiment;

- 10   Figure 18 is a side elevation of the second embodiment;

Figures 19 to 22 show in cross-sectional view a third embodiment of the jiggging device and method of the invention;

Figure 23 is a close-up view of Figure 21;

Figure 24 is a magnified view of the third embodiment;

- 15   Figures 25 and 26 show the third embodiment in longitudinal cross-sectional view;

Figure 27 shows a top view of the third embodiment; and

Figure 28 shows a side elevation of the third embodiment.

### **Detailed Description**

Figures 1 to 3 show a first element (panel 10) being maintained in a spatial relationship with a second element (tubular steel frame 12). Figure 1 shows fastener insert 14 inserted in an opening 16 provided for the purpose in tubular steel frame 12. As can be seen from Figure 2, fastener insert 14 together with adjustable capsule 18 make up the second fastening means. The first fastening means comprises panel fastener 20 which is shown in Figure 2 attached (for example, by glue) to panel 10.

As can be seen from Figure 3, after adjustable capsule 18 is adjusted in the desired way within fastener insert 14, panel fastener 20 can be attached to adjustable capsule 18 and locked in place by locking pin 22.

Adjustable capsule 18 is shown in more detail in Figures 4 to 8, while panel fastener 20 is shown in close-up view in Figure 9. As can be seen from Figures 4 and 5, adjustable capsule 18 has a series of serrations 24 and a locking rim 26 and includes keeper 28.

Figure 8 is a cross-sectional view taken along the lines 8-8 of Figure 4, while Figure 7 is a cross-sectional view taken along the lines 7-7 of Figure 5. As well as keeper 28, the adjustable capsule 18 includes keeper 30. Locking pin 22 is shown located in the region of keeper 28.

A top view of adjustable capsule 18, as shown in Figure 5, can be seen in Figure 6.

With reference to Figure 8, walls 32 of adjustable capsule 18 are capable of flexing inwardly where not prevented by locking pin 22.



Panel fastener 20, shown in Figure 9, includes ridged cylindrical wall 34 and a further keeper 36.

To operate this first embodiment, fastener insert 14 is positioned within tubular steel frame 12, preferably by adhesion. Adjustable capsule 18 is placed within fastener insert 14, with  
5 locking pin 22 in the position shown in Figure 2. Panel fastener 20 is attached to panel 10, once again, preferably by adhesion. Adjustable capsule 18 is adjusted with reference to fastener insert 14 so that, when panel fastener 20 is attached, panel 10 will be at the required distance from tubular steel frame 12. Panel fastener 20 is then attached to adjustable capsule 18 by a push fit, rigid cylindrical wall 34 causing flexible wall 32 to flex inwardly so that  
10 locking rim 26 is located in notch 38 (see Figure 9) of panel fastener 20. Locking pin 22 is caused to move upwardly until it contacts keeper 36 as shown in Figure 3. In this position, locking pin 22 maintains locking rim 26 in notch 38 and effectively locks panel fastener 20 to adjustable capsule 18, thus also maintaining panel 10 in the desired relationship to tubular steel frame 12. Locking pin 22 can be caused to move by any desired means, preferably  
15 remote, such as by use of a radio, magnetic or electronic signal or in any other suitable manner, such as is described in international patent application No. PCT/AU99/00185.

Referring now to Figures 10 to 14, once again fastener insert 14 is shown inserted in tubular steel frame 12 (Figure 10). However, in this embodiment the first element is panel 10, while the second element is frame 12. Adjustable plate 40 having neck 42 is positioned within  
20 fastener insert 14. Locking pin 44 is at this stage in the unlocked position (refer to Figures 11 and 12). Panel plate 46 having locking pins 48 is then inserted in position on adjustable plate 40, which is adjusted as to the correct height for the relationship between panel 10 and tubular steel frame 12 (Figure 12). Once the correct height has been adjusted, adjustable

plate 40 is locked into place within fastener insert 14 by causing locking pin 44 to abut keeper 50, as shown in Figure 13. Panel plate 46 is removed from adjustable plate 40, adhered to panel 12 and then reinserted in adjustable plate 40. If desired, locking pins 48 can be caused to lock panel plate 46 into position. As a further option, adhesive may now be  
5 inserted generally between panel 10 and tubular steel frame 12. This is further illustrated in Figures 15 and 16, which are a longitudinal cross-section taken at right angles to the views in Figures 10 to 14.

Figure 14 shows in close-up view fastener insert 14, adjustable plate 40 and panel plate 46. As is the case in the first embodiment (for example in Figure 1), fastener insert 14 includes  
10 internal serrations 52. Channel 54 is for location of tubular steel frame 12. Adjustable plate 40 has serrations 24 complementing internal serrations 52 on fastener insert 14. Keeper 50 maintains the legs of neck 42 in position. Adjustable plate 40 also includes resilient legs 56 and spacing legs 58. Resilient legs 56 are designed to lock legs 60 on panel plate 46 in channels 62. Panel plate 46, which is attached by adhesive 64 to panel 10 in Figure 13,  
15 includes locking pins 48 having keepers 66 and 68. Adjustable plate 40 is locked to tubular steel frame 12 by causing locking pin 44 to travel downwardly to abut keeper 50, as shown in Figure 13. Panel plate 46 is locked to adjustable plate 40 by causing locking pins 48 to move downwardly from the position shown in Figure 11 to that in Figure 12, for example. As before, the locking of locking pins 44 and 48 is optionally reversible by use of remote  
20 activation means.

As seen from Figures 15 and 16, a large quantity of adhesive 70 can be deposited on tubular steel frame 12 after panel plate 46 is unlocked from adjustable plate 40 for this purpose. Panel plate 46 is then locked into position in adjustable plate 40 to maintain the desired

spatial relationship between panel 10 and tubular steel frame 12 while adhesive 70 cures (refer Figure 16).

A top view of the second embodiment is shown in Figure 17 and a side elevation in Figure 18.

- 5 The third embodiment is shown in Figures 19 to 28. This embodiment is similar to the previous embodiment and like parts will be labelled with like numbers. However, whereas the previous embodiment showed a double fastener via locking pins 48 in panel plate 46, the present embodiment has a single fastener with two locking pins.

As before, fastener insert 14 is positioned within tubular steel frame 12 as in Figure 19 and  
10 neck 42 is adjusted in position using locking pin 44. After panel 10 has been adhered to panel fastener 72, panel 10 is checked for correct positioning in relation to tubular steel frame 12, as in Figure 21. Panel fastener 72 is then released from adjustable plate 40, as in Figure 22 and Figure 25. Adhesive 70 is deposited on tubular steel frame 12 and panel 10 and panel fastener 72 replaced and locked into position as shown in Figure 26.

- 15 Figure 27 shows this embodiment in top view and Figure 28 shows it in side elevation. It will be appreciated that Figure 26 is a longitudinal sectional view taken along the lines A-A of Figure 27, while Figure 23 is a cross-sectional view taken along the lines B-B of Figure 28.

The detail of this embodiment can be seen from Figure 24, which includes keepers 74, 76 and  
20 78 as well as locking pins 80.

It will be appreciated by one skilled in the art that various changes may be made to the embodiments described and that other modifications may be effected without departing from the spirit and scope of the invention. For example, it is within the scope of the invention to have the adjustment means on the fastening means attached to the panel rather than to the  
5 tubular steel frame, as illustrated. It is also within the scope of the invention to have adjustment means on both fastening means.

### **Industrial Applicability**

The invention represents an important advance in jigging arrangements and is capable of making assembly line production far more accurate and efficient, while at the same time  
10 greatly reducing costs.